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Yang

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(54) **HEAD MOUNTED DISPLAY**

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G02B 27/01 (2006.01)

(52) **U.S. Cl.**
CPC ***G02B 27/017*** (2013.01)

(58) **Field of Classification Search**
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USPC 345/7, 8, 156–184
See application file for complete search history.

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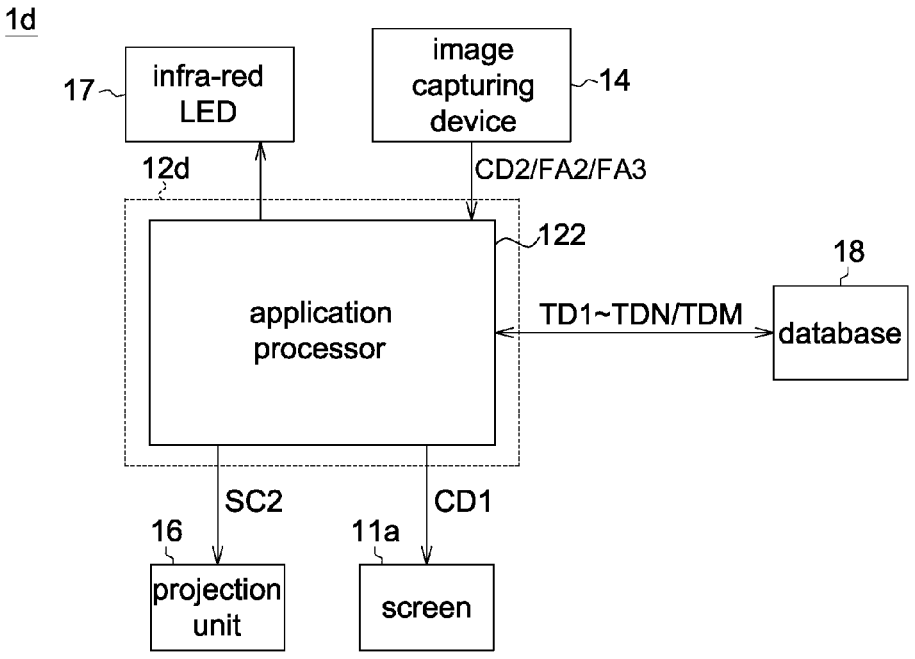
(57) **ABSTRACT**

A head mounted display (HMD) is disclosed. The HMD comprises a screen, a processing circuit and an eyeglass frame. The screen displays a coded data associated with an exchange information. The processing circuit outputs the coded data to the screen. The eyeglass frame carries the screen and the processing circuit.

20 Claims, 8 Drawing Sheets



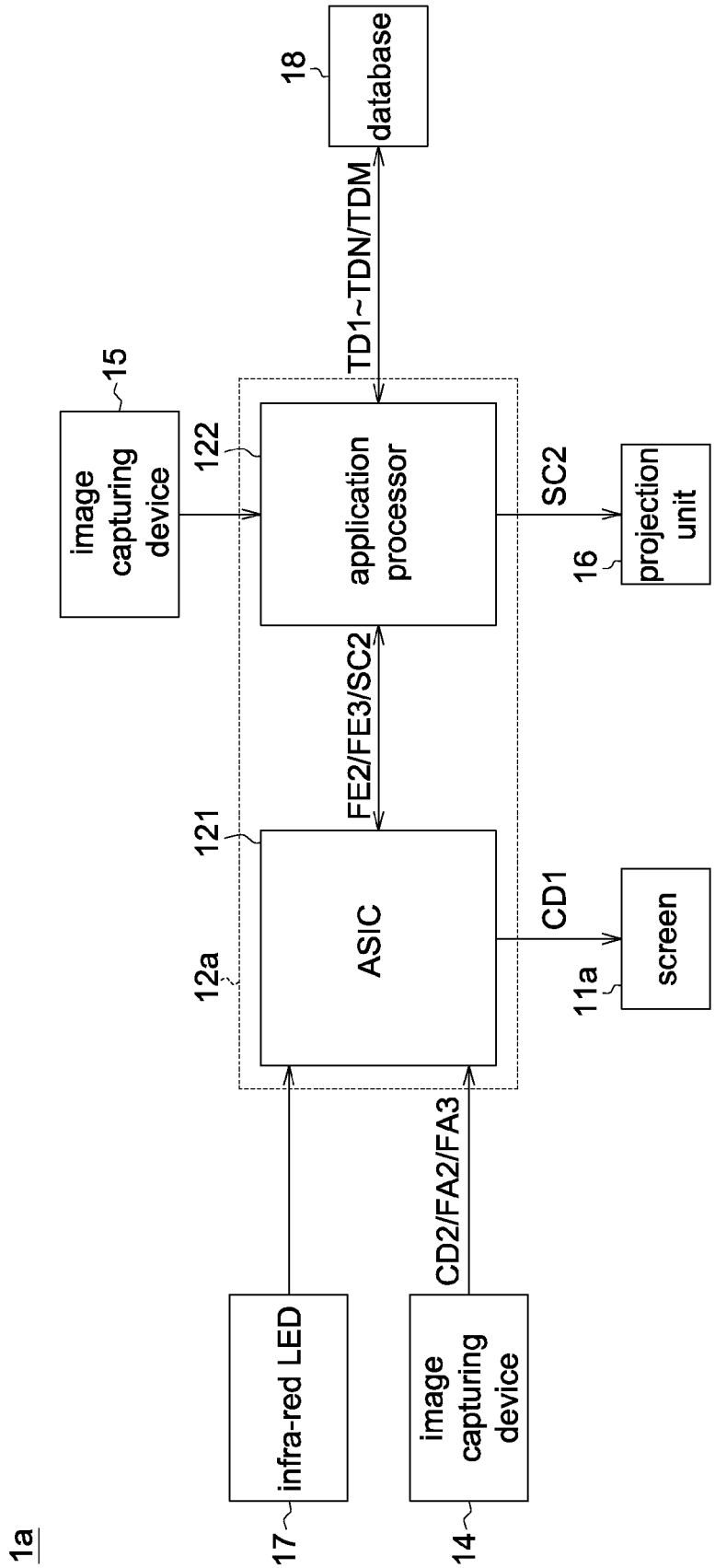

1a
18
database
TD1~TDN/TDM
15
image capturing device
122
application processor
SC2
16
projection unit
FE2/FE3/SC2
121
ASIC
CD1
12a
11a
screen
CD2/FA2/FA3
infra-red LED
17
image capturing device
14

FIG. 1

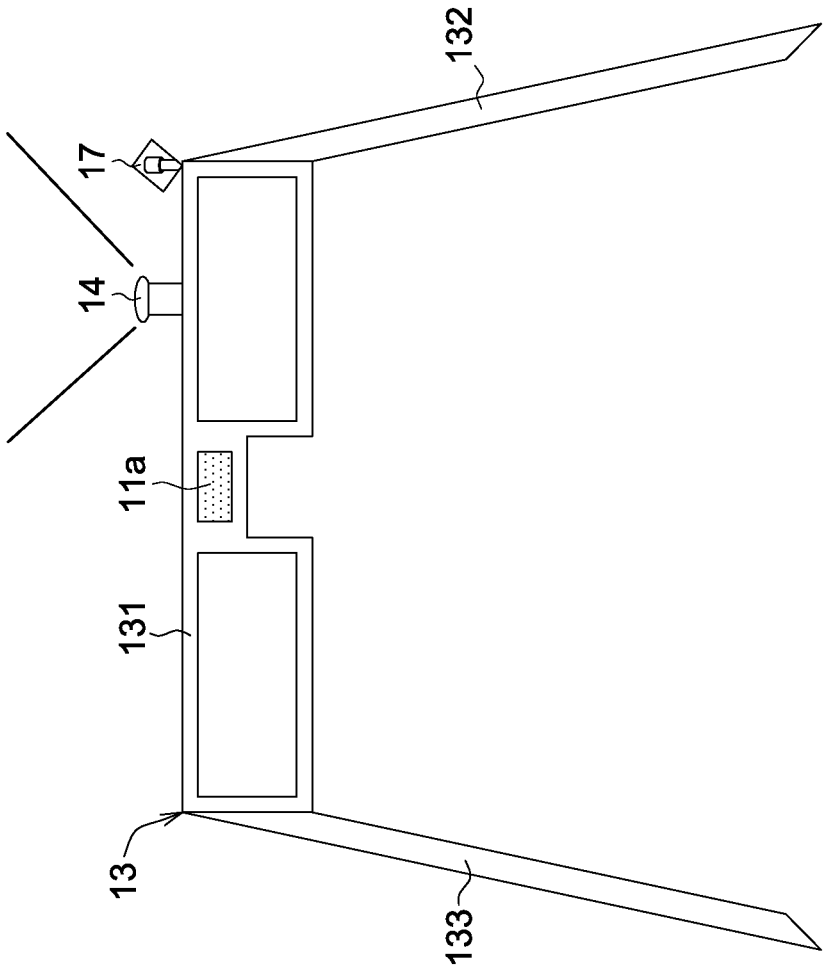


FIG. 2

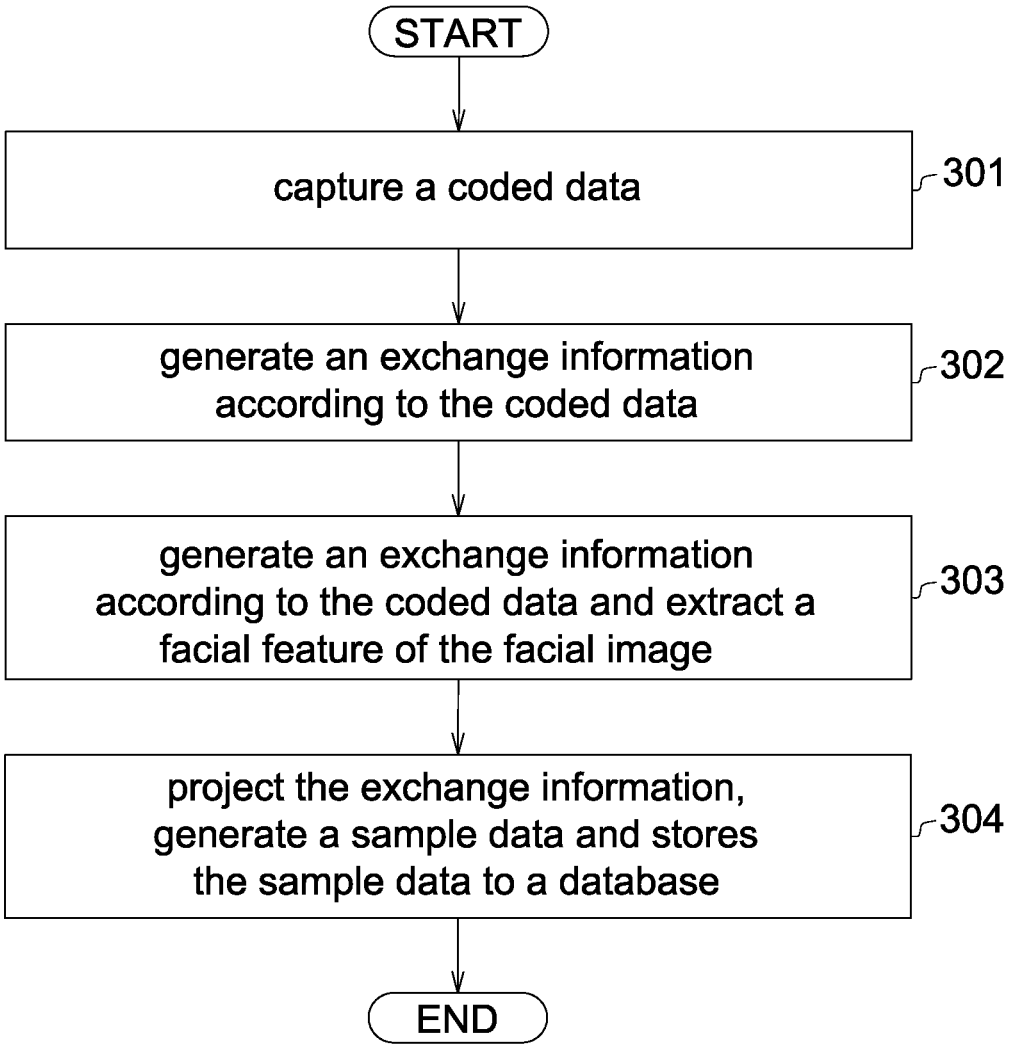

START
capture a coded data
301
generate an exchange information according to the coded data
302
generate an exchange information according to the coded data and extract a facial feature of the facial image
303
project the exchange information, generate a sample data and stores the sample data to a database
304
END

FIG. 3

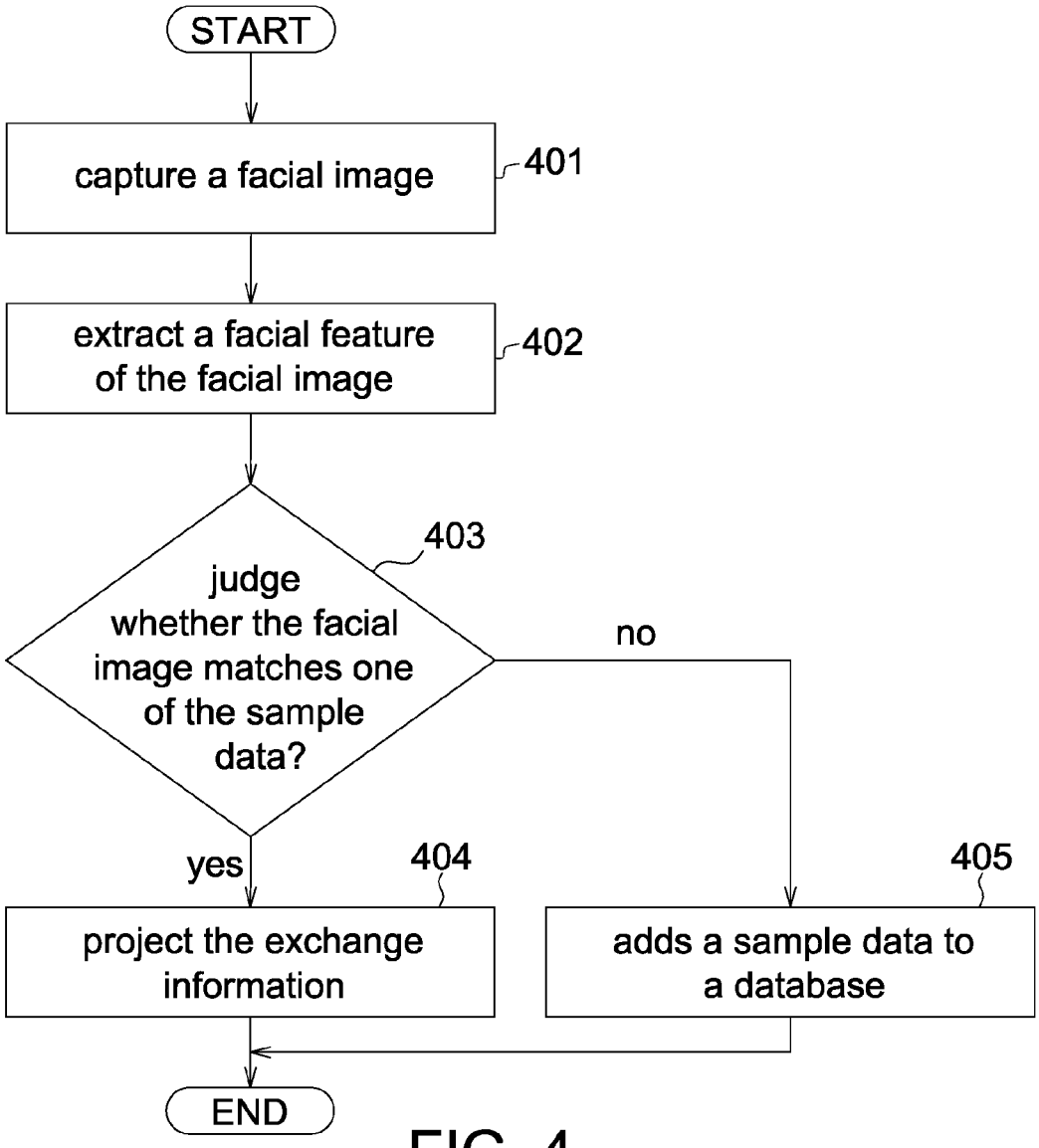

START
capture a facial image
401
extract a facial feature of the facial image
402
judge whether the facial image matches one of the sample data?
403
no
yes
404
405
project the exchange information
adds a sample data to a database
END

FIG. 4

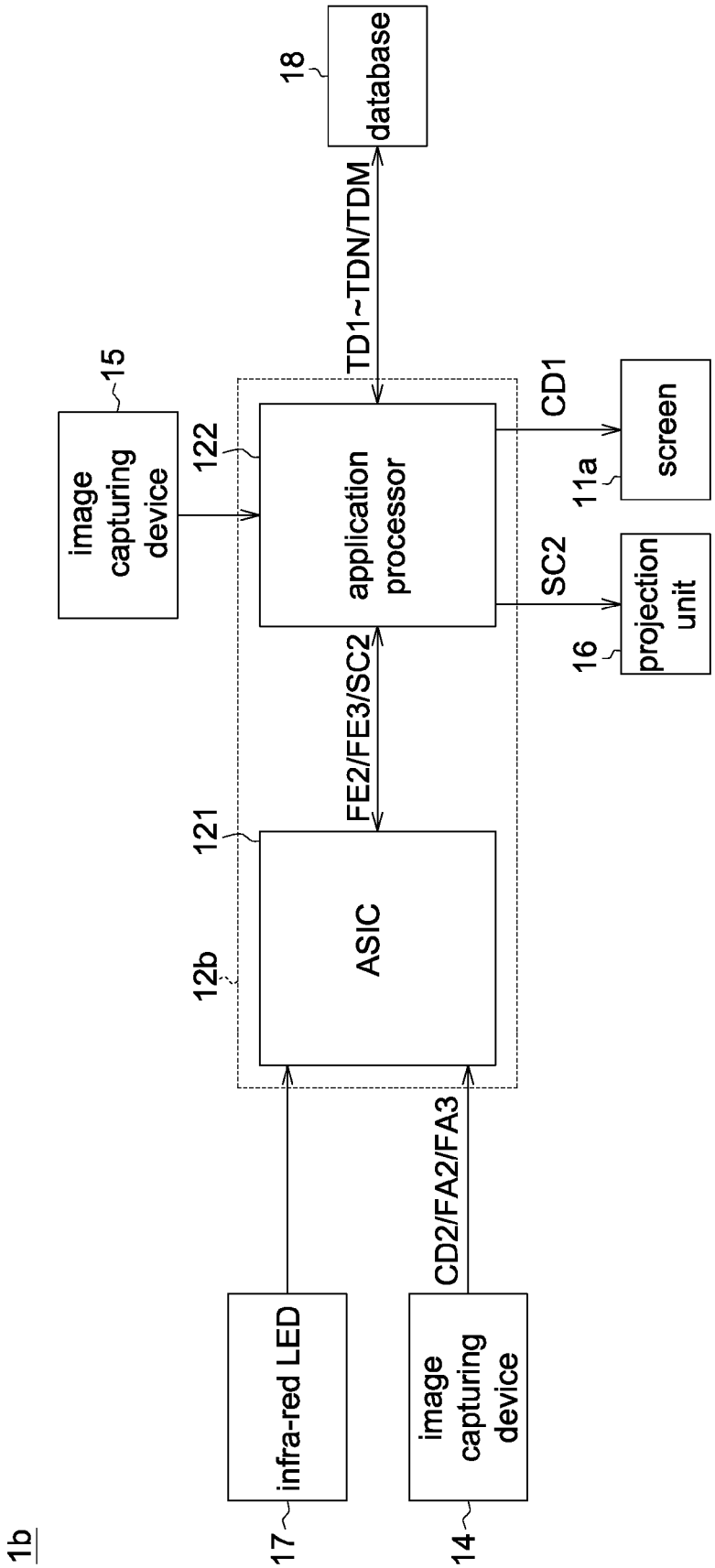

1b
17
infra-red LED
14
image capturing device
CD2/FA2/FA3
12b
ASIC
121
FE2/FE3/SC2
16
projection unit
SC2
11a
screen
CD1
122
application processor
15
image capturing device
TD1~TDN/TDM
18
database

FIG. 5

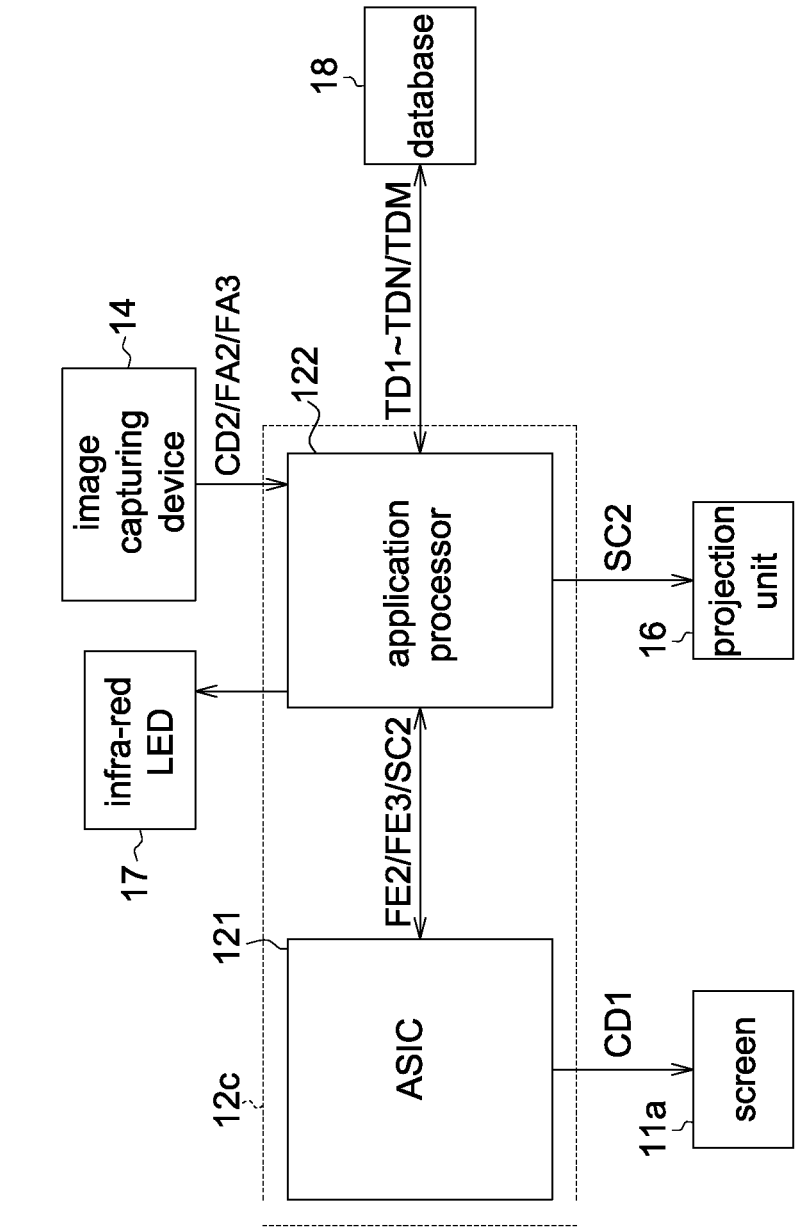

1c
18
database
TD1~TDN/TDM
14
image capturing device
CD2/FA2/FA3
122
application processor
SC2
16
projection unit
infra-red LED
17
FE2/FE3/SC2
121
ASIC
CD1
12c
11a
screen

FIG. 6

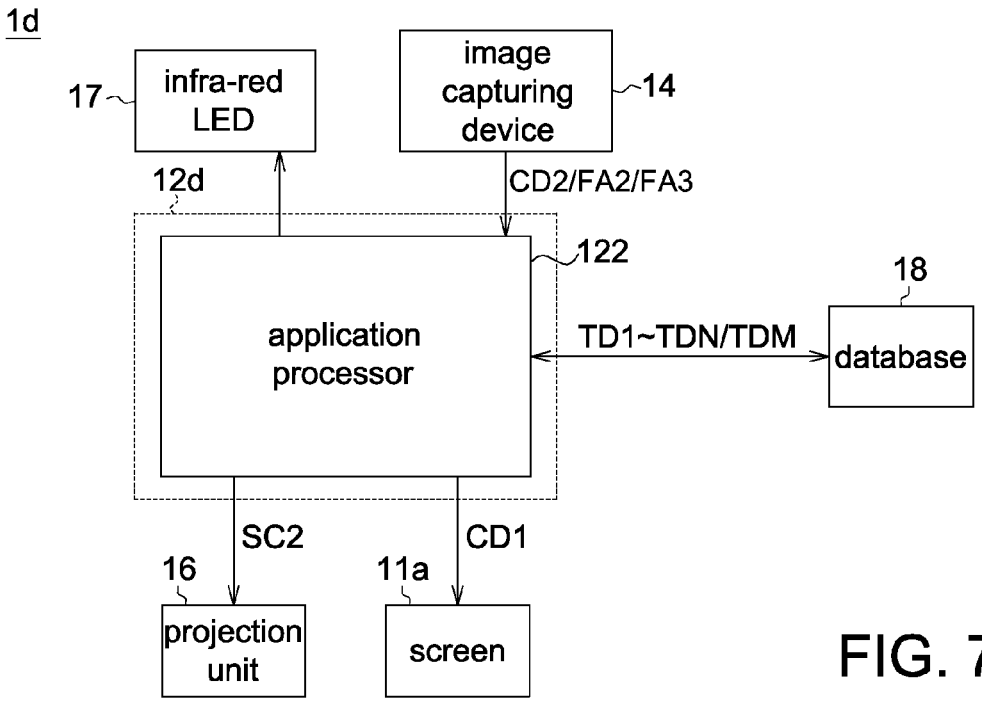

1d
17
infra-red LED
image capturing device
14
12d
CD2/FA2/FA3
122
18
application processor
TD1~TDN/TDM
database
SC2
CD1
16
11a
projection unit
screen

FIG. 7

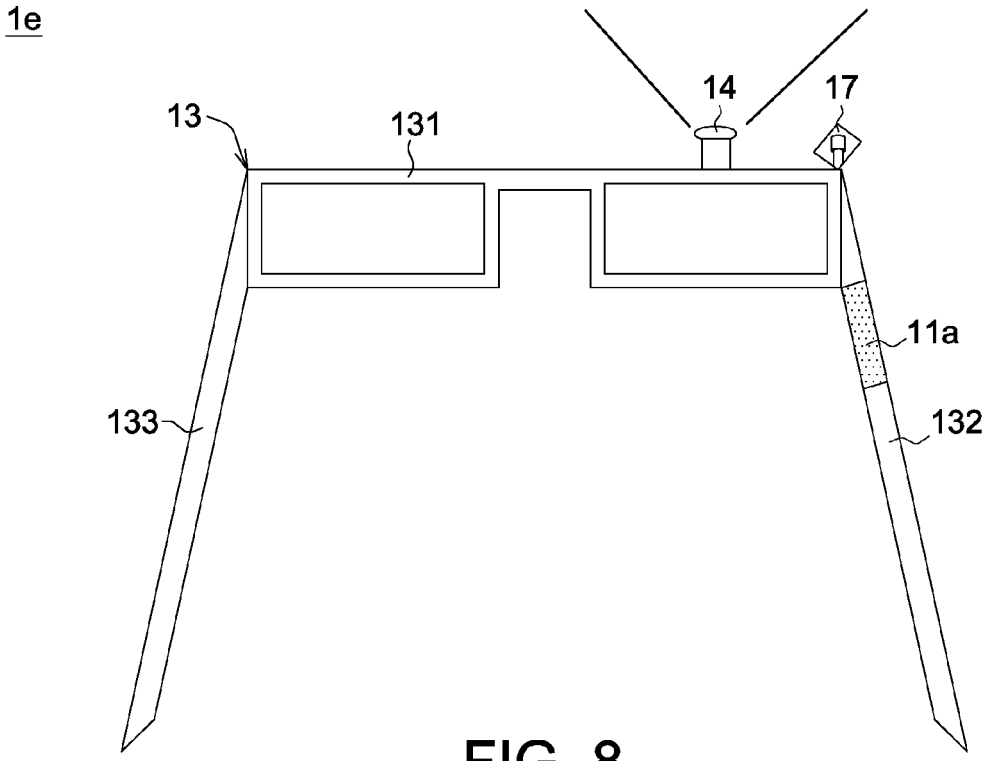

1e
13
131
14
17
11a
133
132

FIG. 8

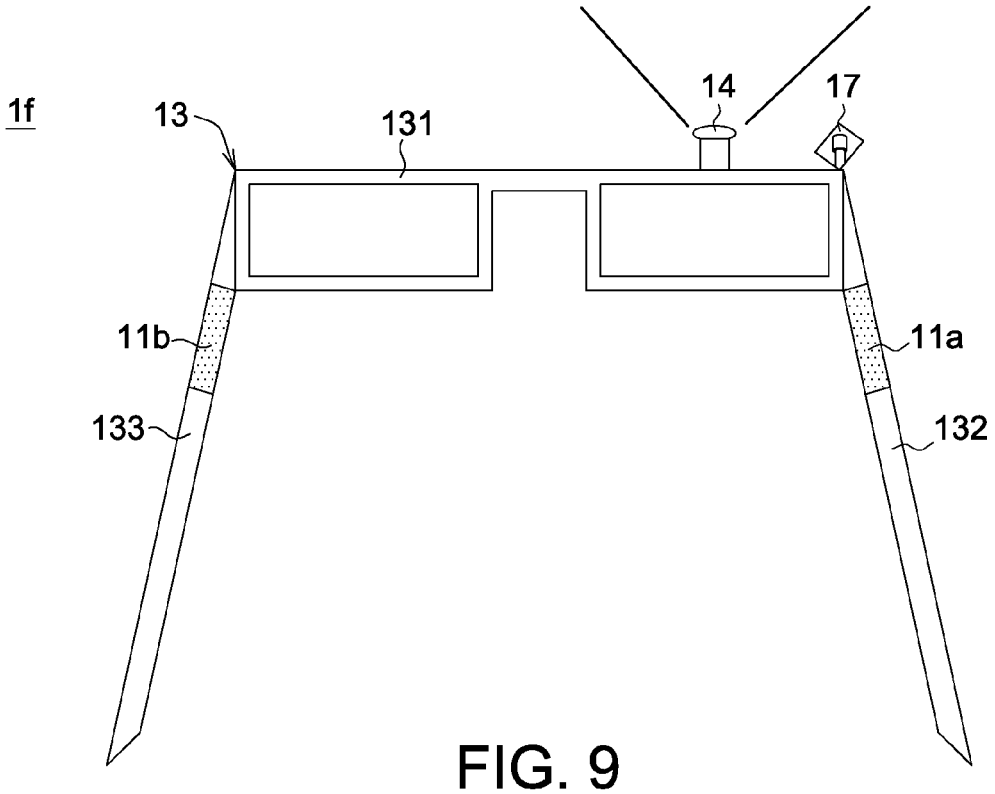


FIG. 9

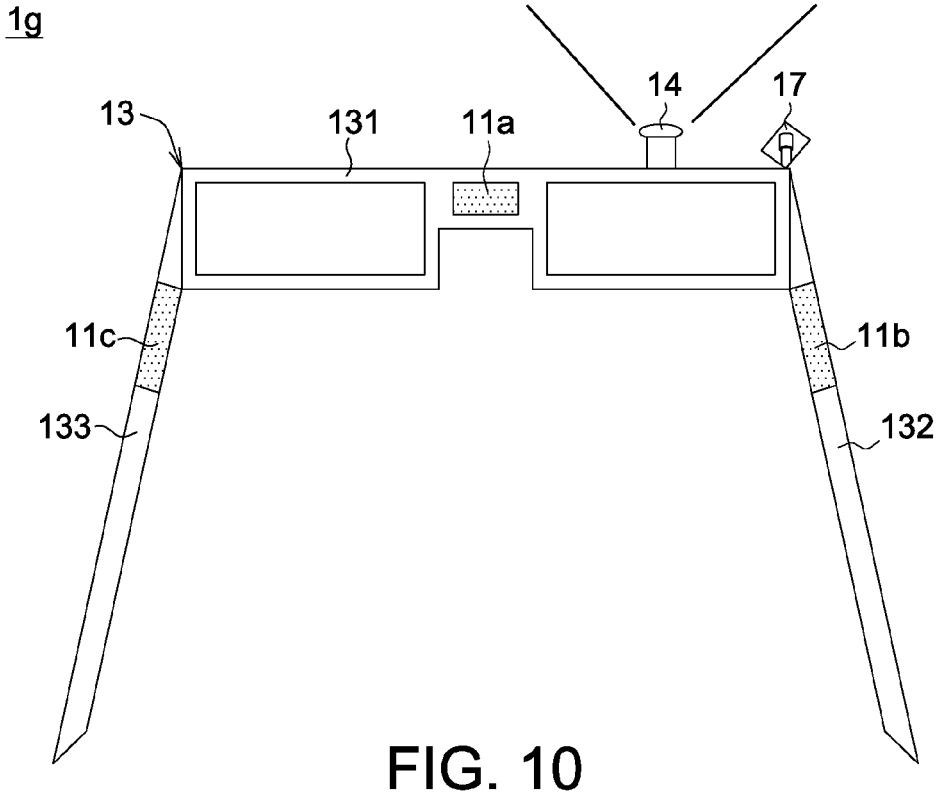


FIG. 10

HEAD MOUNTED DISPLAY

This application claims the benefit of Taiwan application Serial No. 103110647, filed Mar. 21, 2014, the subject matter of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates in general to an electronic apparatus and more particularly to a head mounted display (HMD).

2. Description of the Related Art

Along with the advance in technology, people assimilate more and more information every day. Commonly seen electronic apparatuses such as multimedia play apparatus, network communication apparatus and computer apparatus are equipped with a cathode ray tube (CRT) or a liquid crystal display (LCD) for displaying images. However, the pixels and size of a displayed image depend on the size and efficiency of the display and a conventional CRT or LCD cannot meet the requirements of large size and convenient portability at the same time. To resolve the above problem, an optical see-through head mounted display (HMD) is provided. The head mounted display apparatus has a CRT or LCD disposed in front of each eye. The head mounted display apparatus projects the images outputted by respective CRT or LCD onto the user's retinas through beam splitters and creates a 3D effect by using the parallax between the user's two eyes.

SUMMARY OF THE INVENTION

The invention is directed to a head mounted display (HMD).

According to one embodiment of the present invention, a head mounted display (HMD) is disclosed. The HMD comprises a screen, a processing circuit and an eyeglass frame. The screen displays a coded data associated with an exchange information. The processing circuit outputs the coded data to the screen. The eyeglass frame carries the screen and the processing circuit.

The above and other aspects of the invention will become better understood with regard to the following detailed description of the preferred but non-limiting embodiment (s). The following description is made with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a configuration diagram of a head-mounted display according to a first embodiment.

FIG. **2** is an appearance diagram of a head-mounted display according to a first embodiment.

FIG. **3** is a flowchart of generating a sample data according to the coded data.

FIG. **4** is a flowchart of displaying an exchange information according to the facial image.

FIG. **5** is a configuration diagram of a head-mounted display according to a second embodiment.

FIG. **6** is a configuration diagram of a head-mounted display according to a third embodiment.

FIG. **7** is a configuration diagram of a head-mounted display according to a fourth embodiment.

FIG. **8** is an appearance diagram of a head-mounted display according to a fifth embodiment.

FIG. **9** is an appearance diagram of a head-mounted display according to a sixth embodiment.

FIG. **10** is an appearance diagram of a head-mounted display according to a seventh embodiment.

DETAILED DESCRIPTION OF THE INVENTION

First Embodiment

Refer to FIG. **1** and FIG. **2**. FIG. **1** is a configuration diagram of a head-mounted display according to a first embodiment. FIG. **2** is an appearance diagram of a head-mounted display according to a first embodiment. The HMD **1***a* comprises a screen **11***a*, a processing circuit **12***a*, an eyeglass frame **13**, an image capturing device **14**, an image capturing device **15**, a projection unit **16**, an infra-red LED **17** and a database **18**. The eyeglass frame **13** carries the screen **11***a*, the processing circuit **12***a*, the image capturing device **14**, the image capturing device **15**, the projection unit **16**, the infra-red LED **17** and the database **18**. The eyeglass frame **13** comprises a frame **131** and handles **132** and **133**. The frame **131** is located between the handles **132** and **133**, and the screen **11***a* is disposed at the center of the frame **131**.

The screen **11***a* displays a coded data CD**1** associated with the user's exchange information. Based on the different natures of social occasions, the user may decide which the exchange information to open. The exchange information is such as the user's hobbies, blog website, Facebook account, e-mail address, occupation, sharing of gourmet and travel experiences, research topics and thesis. The coded data CD**1** can be realized by a two-dimensional matrix barcode such as a QR code, a micro QR code, a data matrix or an Aztec code.

The processing circuit **12***a* outputs the coded data CD**1** to the screen **11***a*. The image capturing device **14** captures a coded data CD**2** displayed on the screen of someone's HMD and the facial image FA**2** associated with the coded data CD**2**. The coded data CD**2** can be realized by a two-dimensional matrix barcode such as a QR code, a micro QR code, a data matrix or an Aztec code. When the ambient light is not sufficient, the processing circuit **12***a* can activate the infra-red LED **17** to provide an auxiliary light source to the image capturing device **14**. The database **18** stores sample data TD**1**~TDN. The processing circuit **12***a* generates someone's exchange information SC**2** according to the coded data CD**2** and generates the sample data TD**2** according to the exchange information SC**2**. The projection unit **16** projects someone's exchange information SC**2** to the user's eyes.

Furthermore, the processing circuit **12***a* comprises an application specific integrated circuit (ASIC) **121** and an application processor **122**. The ASIC **121** is connected to the application processor **122** and communicates with the application processor **122** through a universal serial bus (USB). The ASIC **121** is connected to the infra-red LED **17** and communicates with the infra-red LED **17** through a general purpose input output (GPIO). The ASIC **121** is connected to the image capturing device **14** and communicates with the image capturing device **14** through a mobile industry processor interface (MIPI) or a parallel I/F. The ASIC **121** is connected to the screen **11***a* and communicates with the screen **11***a* through the display I/F. The application processor **122** is connected to the image capturing device **15** and communicates with the image capturing device **15** through the mobile industry processor interface (MIPI). The image capturing device **15** can be realized by such as a video camera. The application processor **122** is connected to the projection unit **16** and communicates with the projection unit **16** through the display I/F. The eyeglass frame **13** comprises a frame **131** and handles **132** and **133**. The frame **131** is located between the handles **132** and **133** and the screen **11***a* is disposed at the center of the frame **131**.

Refer to FIG. **1** and FIG. **3**. FIG. **3** is a flowchart of generating a sample data according to the coded data. Firstly, the method begins at step **301**, the image capturing device **14** captures a coded data CD**2** displayed on the screen of someone's HMD. When the coded data CD**2** is a QR code, the position detection pattern of the QR code will help the processing circuit **12***a* to identify a facial image in subsequent processing. Next, the method proceeds to step **302**, the processing circuit **12***a* generates someone's exchange information SC**2** according to the coded data CD**2** and the image capturing device **14** captures a facial image FA**2** associated with the coded data CD**2**.

Then, the method proceeds to step **303**, the processing circuit **12***a* generates someone's exchange information SC**2** according to the coded data CD**2** and extracts a facial feature FE**2** of the facial image FA**2**. The facial image FA**2** corresponds to the exchange information SC**2**. Then, the method proceeds to step **304**, the projection unit **16** projects the exchange information SC**2** to the user's eyes and the processing circuit **12***a* generates a sample data TD**2** and further stores the sample data TD**2** to the database **18**. The sample data TD**1** and the sample data TD**3**~TDN can also be generated through the above procedures. The sample data TD**1**~TDN can have different implementations. For example, the processing circuit **12***a* generates the sample data TD**2** according to the exchange information SC**2** and the facial image FA**2** and the sample data TD**2** is such as a combination of the exchange information SC**2** and the facial image FA**2**. Or, the processing circuit **12***a* generates the sample data TD**2** according to the exchange information SC**2** and the facial feature FE**2** and the sample data TD**2** is such as a combination of the exchange information SC**2** and the facial feature FE**2**. Or, the processing circuit **12***a* generates the sample data TD**2** according to the exchange information SC**2**, the facial image FA**2** and the facial feature FE**2** and the sample data TD**2** is such as a combination of the exchange information SC**2**, the facial image FA**2** and the facial feature FE**2**.

Refer to FIG. **1** and FIG. **4**. FIG. **4** is a flowchart of displaying an exchange information according to the facial image. Firstly, the method begins at step **401**, the image capturing device **14** captures a facial image FA**3**. Next, the method proceeds to step **402**, the processing circuit **12***a* extracts a facial feature FE**3** of the facial image FA**3**. Then, the method proceeds to step **403**, the processing circuit **12***a* judges whether the facial image FA**3** matches one of the sample data TD**1**~TDN stored in the database **12**. Furthermore, the processing circuit **12***a* calculates an Euclidean distance according to the facial features of the sample data TD**1**~TDN and the facial feature FE**3** of the facial image FA**3**. When the Euclidean distance between the facial feature FE**2** and the facial feature FE**3** is the smallest and the Euclidean distance is smaller than a threshold, this implies that the facial image FA**3** matches the sample data TD**2**.

When the facial image FA**3** matches the sample data TD**2**, the method proceeds to step **404**, the processing circuit **12***a* controls the projection unit **16** to project the exchange information SC**2**. Conversely, when the facial image FA**3** does not match the sample data TD**2**, the method proceeds to step **405**, the processing circuit **12***a* adds a sample data TDM to the database **18**. The sample data TDM can have different implementations. For example, the processing circuit **12***a* generates the sample data TDM according to the facial feature FE**3** and the user's annotations and the user can edit the annotations according to the facial image FA**3**. The sample data TDM is such as a combination of the facial image FA**3** and the facial feature FE**3**. Or, the processing circuit **12***a* generates the sample data TDM according to the facial image FA**3**, the facial feature FE**3** and the user's annotations. The sample data TDM is such as a combination of the facial image FA**3**, the facial feature FE**3** and the user's annotations.

Second Embodiment

Refer to FIG. **1** and FIG. **5**. FIG. **5** is a configuration diagram of a head-mounted display according to a second embodiment. The HMD **1***b* is different from the HMD **1***a* mainly in that the screen **11***a* of the HMD **1***b* is connected to the application processor **122** rather than the ASIC **121** of the processing circuit **12***b*.

Third Embodiment

Refer to FIG. **1** and FIG. **6**. FIG. **6** is a configuration diagram of a head-mounted display according to a third embodiment. The HMD **1***c* is different from the HMD **1***a* mainly in that the infra-red LED **17** and the image capturing device **14** of the HMD **1***c* are connected to the application processor **122** rather than the ASIC **121** of the processing circuit **12***c*.

Fourth Embodiment

Refer to FIG. **1** and FIG. **7**. FIG. **7** is a configuration diagram of a head-mounted display according to a fourth embodiment. The HMD **1***d* is different from the HMD **1***a* mainly in that the processing circuit **12***d* of the HMD **1***d* does not comprise an ASIC **121**. The screen **11***a*, the infra-red LED **17** and the image capturing device **14** of the HMD **1***d* are connected to the application processor **122**.

Fifth Embodiment

Refer to FIG. **2** and FIG. **8**. FIG. **8** is an appearance diagram of a head-mounted display according to a fifth embodiment. The HMD **1***e* is different from the HMD **1***a* mainly in that the screen **11***a* of the HMD **1***e* is disposed on the handle **132** rather than the frame **131**.

Sixth Embodiment

Refer to FIG. **8** and FIG. **9**. FIG. **9** is an appearance diagram of a head-mounted display according to a sixth embodiment. The HMD **1***f* is different from the HMD **1***e* mainly in that the HMD **1***f* further comprises a screen **11***b* disposed on the handle **132**. The screen **11***a* and the screen **11***b* can display the same or different coded data. When the screen **11***a* and the screen **11***b* display different coded data, the coded data displayed on the screen **11***a* and the screen **11***b* are associated with the user's exchange information. That is, when the exchange information that the user wants to share cannot be compressed as one coded data, the exchange information can be compressed as two coded data: one is displayed on the screen **11***a* and the other one is displayed on the screen **11***b*.

Seventh Embodiment

Refer to FIG. **2** and FIG. **10**. FIG. **10** is an appearance diagram of a head-mounted display according to a seventh embodiment. The HMD **1***g* is different from the HMD **1***a* mainly in that the HMD **1***g* further comprises a screen **11***b* and a screen **11***c*. The screen **11***b* is disposed on the handle **132** and the screen **11***c* is disposed on the handle **133**. Similarly, the screen **11***a*, the screen **11***b* and the screen **11***c* can display the same or different coded data. When the screen **11***a*, the screen **11***b* and the screen **11***c* display different coded data, the coded data displayed on the screen **11***a*, the screen **11***b* and the screen **11***c* are associated with the user's exchange information. That is, when the exchange information that the user wants to share cannot be compressed as one coded data, the exchange information can be compressed as three coded data: one is displayed on the screen **11***a*, another one is displayed on the screen **11***b* and the remaining one is displayed on the screen **11***c*.

While the invention has been described by way of example and in terms of the preferred embodiment (s), it is to be understood that the invention is not limited thereto. On the

contrary, it is intended to cover various modifications and similar arrangements and procedures and the scope of the appended claims therefore should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements and procedures.

What is claimed is:

1. A head-mounted display (HMD), comprising:

a first screen for displaying first coded data associated with first exchange information;

a processing circuit for outputting the first coded data to the first screen; and

an eyeglass frame for carrying the first screen and the processing circuit;

wherein the eyeglass frame comprises a frame, a first handle and a second handle, the frame is located between the first handle and the second handle and the first screen is disposed on the first handle.

2. The head-mounted display according to claim **1**, further comprising:

a database for storing at least a sample data;

an image capturing device for capturing second coded data, wherein the processing circuit generates second exchange information according to the second coded data and generates the sample data according to the second exchange information; and

a projection unit for projecting the second exchange information.

3. The head-mounted display according to claim **2**, wherein the image capturing device captures a first facial image associated with the second coded data.

4. The head-mounted display according to claim **3**, wherein the processing circuit extracts a plurality of first facial features of the first facial image.

5. The head-mounted display according to claim **4**, wherein the processing circuit generates the sample data according to the second exchange information and the first facial features.

6. The head-mounted display according to claim **4**, wherein the processing circuit generates the sample data according to the second exchange information, the first facial image and the first facial features.

7. The head-mounted display according to claim **4**, wherein the image capturing device captures a second facial image, the processing circuit extracts a plurality of second facial features of the second facial image and judges whether the second facial image matches the sample data and when the second facial image matches the sample data, the processing circuit controls the projection unit to project the second exchange information.

8. The head-mounted display according to claim **7**, wherein when the second facial image does not match the sample data, the processing circuit adds another sample data to the database, the processing circuit generates the another sample data according to the second facial features and a user's annotations.

9. The head-mounted display according to claim **7**, wherein the processing circuit calculates an a Euclidean distance according to the first facial features and the second facial features, when the Euclidean distance is the smallest and the Euclidean distance is smaller than a threshold, the second facial image matches the sample data.

10. The head-mounted display according to claim **3**, wherein the processing circuit generates the sample data according to the second exchange information and the first facial image.

11. The head-mounted display according to claim **2**, wherein the processing circuit comprises an application specific integrated circuit (ASIC) and an application processor, the ASIC is connected to the application processor, the image capturing device and the first screen are connected to the ASIC and the projection unit is connected to the application processor.

12. The head-mounted display according to claim **2**, wherein the processing circuit comprises an application specific integrated circuit (ASIC) and an application processor, the ASIC is connected to the application processor, the image capturing device is connected to the ASIC and the projection unit and the first screen are connected to the application processor.

13. The head-mounted display according to claim **2**, wherein the processing circuit comprises an application specific integrated circuit (ASIC) and an application processor, the ASIC is connected to the application processor, the first screen is connected to the ASIC and the projection unit and the image capturing device are connected to the application processor.

14. The head-mounted display according to claim **2**, wherein the processing circuit comprises an application processor, the first screen, the projection unit and the image capturing device are connected to the application processor.

15. The head-mounted display according to claim **1**, further comprising:

a second screen for displaying a second coded data associated with the first exchange information.

16. The head-mounted display according to claim **15**, wherein the second screen is disposed on the second handle.

17. The head-mounted display according to claim **15**, further comprising:

a third screen for displaying third coded data associated with the first exchange information.

18. The head-mounted display according to claim **17**, wherein the third screen is disposed on the second handle.

19. The head-mounted display according to claim **1**, wherein the first coded data is a two-dimensional matrix barcode.

20. The head-mounted display according to claim **19**, wherein the two-dimensional matrix barcode is a QR code, a micro QR code, a data matrix or an Aztec code.

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